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Milking It For All It's Worth

- Wisconsin leads the nation in a growing renewable energy option -

The dairy industry is an essential part of Wisconsin agriculture and is vital to the state's economy. This is why Wisconsin dairy farmers are looking to stay innovative within their industry. One way they are doing this is by producing much more than milk — they are producing energy.

Wisconsin farmers searching for solutions to increasing energy costs as well as environmental pressures surrounding manure management are looking in the direction of anaerobic digestion — turning manure into usable energy. In fact, so many are turning to this technology that Wisconsin now leads the nation in renewable energy from farm anaerobic digesters.

“Farming in Wisconsin continues to grow from smaller family-owned farms, to larger family-owned incorporated farms,” said Larry Krom, sector manager for Focus on Energy’s Renewable Energy Program. “This growth means larger herds and more manure. This manure needs to be managed and doing this with anaerobic digesters makes sense economically and environmentally.”

What is an anaerobic digester?

In technical terms, anaerobic digestion is the bacterial decomposition of organic matter, such as manure, that occurs in the absence of oxygen. An anaerobic digester system is an enclosed tank that excludes oxygen and through which manure is passed and broken down by naturally occurring bacteria, producing biogas. This biogas is composed of approximately 55 percent to 70 percent methane.

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The methane produced in the process can be used in an engine-generator to produce electricity. Even though the electricity produced is more than enough to sustain the farm, most farms with anaerobic digesters sell all the electricity back to the utility company to create an income stream. For example, a typical dairy farm with 600 cows can produce between 54,000 cubic feet to 65,000 cubic feet of biogas a day. With this volume, a 120 kilowatt (kW) generator can produce about 2,400 kilowatt hours (kWh) to 2,650 kWh of electricity per day as well as significant heat recovery. This recovered heat is in turn used to heat the digester, and can also be used for water or space heating.

The electricity and heat produced from an anaerobic digester contributes to combating rising energy costs and reliance on imported fossil fuels. In addition, using anaerobic digestion has a number of environmental benefits. Anaerobic digesters degrade volatile organic compounds in manure, thus reducing odor emissions by up to 97 percent over fresh manure. Also, fly eggs are killed during anaerobic digestion, reducing the disease-causing pest.

More important than minimizing odor is minimizing the possibility of surface or groundwater pollution. Farms without an anaerobic digestion system typically store their manure in pits or lagoons. This practice allows methane to be released into the atmosphere; the methane released is 21 times more potent than carbon dioxide in causing global warming. Unfortunately, this practice also allows for the possibility of well water contamination. Anaerobic digestion reduces the overall organic contamination potential of manure, making it a lesser threat to water quality in case of an accidental spill.

Who is utilizing anaerobic digestion?

As farms become larger, anaerobic digester systems are becoming a viable means of generating on-farm energy while managing animal waste. They are also affording farms the opportunity to reduce their reliance on fossil fuels and reduce pollution. Making implementation even more accessible, Focus on Energy, Wisconsin's energy efficiency and renewable energy initiative, offers technical as well as financial assistance throughout the entire process of installing an anaerobic digester.

The following Wisconsin farms, with the assistance of Focus on Energy, have installed anaerobic digester systems that have aided them in becoming more energy independent and improve their business while helping keep Wisconsin's energy and environmental needs in check:

Suring Community Dairy in Suring, Wis. is using an anaerobic digester to produce heat and electricity from the manure of the farm's 800 milking cows. "Research was the biggest task, when we decided to get an anaerobic digester," said Raymond Leicht, secretary treasurer of Suring Community Dairy. "We traveled to Denmark and Germany to see the different systems available and to learn how they worked."

While Wisconsin may be on the forefront of anaerobic digestion in the United States, according to Leicht, we have a lot of catching up to do with Europe. "When in Denmark one Dane commented that while the United States was putting a man on the moon, they were figuring out what to do about high energy costs by using bio-energy from all the pigs and cows Denmark had," added Leicht.

The Suring Community Dairy system generates approximately two million kWh of electricity a year, enough to power about 200 average Wisconsin homes every year. As a result the control room, workshop and other space heating needs at Suring Community Dairy will be met. All the farm's electrical needs are being met as well, and the excess electricity is being sold back to their utility company. The \$1.3 million project was helped by a \$45,000 grant from Focus on Energy. The expected payback period of the anaerobic digester is approximately six years to seven years.

There are other advantages that factor into the system's payback period as well. The leftover biosolids are used as bedding for the cows and the leftover bioliquid is used for fertilizer on the farm's alfalfa and corn crops. This saves the farm the cost of purchasing straw for bedding as they had formerly used, as well as the cost of fertilizer. Another advantage is that the bioliquid fertilizer does not contain weed seeds that can get back into the field. The bioliquid fertilizer is also more potent because it contains nutrients that are in a mineralized form and are taken up by plants more readily.

“So far I’m very pleased with the system. My biggest surprise has been how much the bacteria in the system and the cows are parallel in their maintenance,” said Leicht. “Both need to be comfortable with the exact right conditions to work at peak level.”

Green Valley Dairy in Krakow, Wis. boasts 2,500 head of cattle, according to the farm’s co-owner Guy Selsmeyer, and that requires special attention to manure management. “Before we installed the anaerobic digester, we were handling manure as a waste product when what we should have been doing is handling it as a value-added product,” said Selsmeyer.

Green Valley Dairy is using two anaerobic digesters to generate approximately four million kWh of electricity a year, enough to power about 400 average Wisconsin homes every year. The farm sells 100 percent of the electricity generated to the utility company, and then buys some of it back at a special rate. In addition, the farm is looking to use the systems’ excess heat during the winter months. The project’s \$2.2 million cost was offset by a \$45,000 grant from Focus on Energy, and has an expected payback period of approximately six years to seven years.

Like Suring Community Dairy, Green Valley Dairy is using the leftover biosolids as bedding for the cows. “We use 100 percent of the leftover biosolids for bedding. Other farms may change bedding twice a week, where as we do it every day,” said Selsmeyer. “The biosolids are as comfortable if not more comfortable than the sand we used previously. Having clean and comfortable bedding leads to comfortable cows, and comfortable cows lead to good milk production, and good milk production pays the bills.”

Selsmeyer feels that implementing anaerobic digestion is the best thing to do for the dairy industry. “It is our responsibility to handle manure in an environmentally sensitive way,” said Selsmeyer. “The more this technology is embraced, the more it will be developed and improved upon. This is key to maintaining dairy production as the leading industry in Wisconsin.”

Is this system right for your farm?

The optimal time for adopting an anaerobic digester system is when the layout of the farm is being reconsidered. Managing these systems requires daily supervision to ensure they remain functioning as they were intended. To be sure it will work for your farm, several factors should be considered:

- Start by looking at your manure handling capabilities. It is important that there be a year-round supply of fresh manure. Anaerobic digestion systems are available for scraped or flushed manure.
- The size of the farm operation is key. While anaerobic digester systems can work with smaller farms, a minimum of about 450 head to 500 head is the general rule of thumb to be cost effective for current technology.
- The financing of a system should be factored in as well. While some financing barriers may exist, grants and tax credits are available to assist. All financing options should be explored, including those through the U.S. Department of Agriculture, the U.S. Department of Energy, Focus on Energy and the State of Wisconsin.

Finally, installing a new system can take approximately eight months, and another two months will be needed to get it running at its optimal level. A digestion system should be engineered specifically for each individual farm operation, and then properly installed. The primary reasons for anaerobic digesters failing are poor design, improper installation and poor management. Proper operation will provide a cost effective energy solution with the opportunity for producing thousands of dollars worth of electricity every year. Doing your homework from the beginning can pay huge dividends down the road.

To learn more about Focus on Energy and its Renewable Energy Program, or to find out if you qualify for incentives or a grant call 800.762.7077 or visit focusonenergy.com.

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